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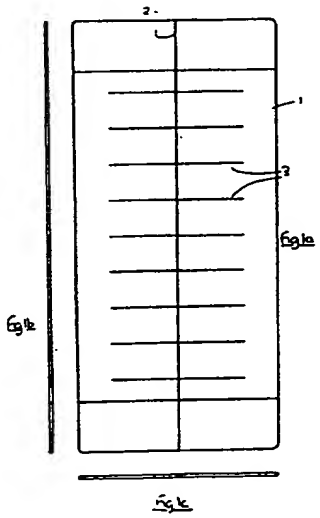
(54) Improvements in the radiographic analysis of bones.

(57) An aid for use in the real time radiographic analysis of bones and comprising a sheet (1) of x-ray previous material at least as large as the bone and carrying a radio-opaque marker (2, 3) against which alignment of the bone may be checked.



EP 0 387 103 A1

IMPROVEMENTS IN THE RADIOGRAPHIC ANALYSIS OF BONES

This invention relates to an aid for use in radiographic analysis of bones and particularly to a device used to aid the reduction of a bone fracture or produce a precise change in alignment in a surgically divided bone. The aid is particularly useful during procedures in an operating theatre but may also be used in an out-patient department.

Bone fractures are often set by eye and the overall bony alignment subsequently confirmed by radiographic analysis. If the alignment is not correct the bone must be reset with consequent distress to the patient and an increase in the use of hospital resources.

Currently mobile X-ray image intensification units are used to visualise the bone in real time, but the field of view is not large enough to view the whole of the bone and so get an impression of the alignment. Also there is some distortion of the image at the edge of the field of view which further hampers assessment of bone alignment.

The invention is an aid to be used in real time in conjunction with an image intensification unit and is especially useful in the setting of long bone fractures and in corrective surgery of the long bones such as the humerus, radius, and ulna, femur and tibia and fibula.

In order to check alignment it is necessary to move the image intensification unit from one end of the bone to the other but, in the absence of a guide it is difficult to check the alignment of the bone.

Devices have been proposed for use in X-ray photography in which features of the human anatomy are photographed against a grid of X-ray opaque material. The grid is inserted between the X-ray source and film, and the resulting exposure shows a shadow of the tissue against a dimensionally accurate grid. Such photographs are used for comparative reference, and diagnostic purposes. These devices have not, however, been proposed for use in real time fluoroscopy where the alignment of the bone is checked in real time against a guide.

U.K. Patent 1366735 for example discloses a measuring grid for use in X-ray photography of tooth cavities, the grid being formed by extremely fine and precisely spaced lines of electro deposited X-ray opaque material.

A particular feature of prior art measuring devices is that none are suitable for use in extending the field of view of mobile X-ray image intensification unit.

Furthermore none of the prior art devices known to the applicants is for use in procedures performed in operating theatres, and none are specifically for orthopaedic or bone fracture applications.

According to the invention there is provided an aid for use in the real time radiographic analysis of bones, the aid comprising a sheet of x-ray pervious material at least as large as the bone and carrying a radio-opaque marker or other low x-ray attenuating material against which alignment of the bone may be checked. Preferably the sheet is of perspex and the marker is in the form of one or more discrete wires of lead.

In a preferred embodiment the marker comprises a grid of discrete lead wires. The radio-opaque marker is preferably incorporated within the sheet for protection and to give a device which is easily cleaned and sterilised.

The invention also provides a method of using the aid in preparation of a bone for surgery or treatment, the method comprising the steps of placing the bone over the aid, providing a real time x-ray image of the bone against the aid and comparing the relative position of bone and marker.

In a preferred embodiment the aid includes a radioopaque grid and, when used for bone alignment, the method further includes the step of adjusting the position of the bone until the image adopts a desired alignment with the grid. The bone may then be set using any conventional technique, such as plaster, plate and screws, intra medullary nail or external fixator.

In addition to being used in alignment of bone fractures, the device may be used in conjunction with a radio-opaque ruler for accurate measurement of bone length; as a means of obtaining an accurate comparison between a pair of bones, and in conjunction with a radio-opaque protractor as a means of designing osteotomies. Two identical aids according to the invention may be used one above and one below the bone to ensure perpendicularity of the x-ray beam with respect to a particular plane through the bone. Alternatively perpendicularity may be checked by the use of two spaced sets of wires in a single perspex sheet to be used either above or below the bone.

Other features of the invention will be apparent from the following description of a preferred embodiment shown by way of example only with reference to the accompanying drawings which:-

Fig 1a is a plan view of a preferred embodiment of the device;

Fig 1b is an elevation of Fig 1a;

Fig 1c is an end view of Fig 1a;

Fig 2a is a perspective view of an alternative form of the device;

Fig 2b is a transverse section through Fig 2a on line 22; and

Fig 2c is an enlarged view of a transverse

wire.

With reference to the drawings there is shown a device (1) comprising a grid of lead wires (2,3) sandwiched between sheets of clear perspex (4,5).

In the embodiment of Fig 2, the grid comprises a number of wires of round section housed with recesses of the sheets; the threads stop short of the edges of the sheets as shown. The sheets are sealed to each other so that the aid may be readily cleaned and sterilised after use without the risk of damaging the grid.

Since the device is used in surgery it is most important that it be suitable for sterlising in an autoclave.

The grid may be formed of strips of lead or of any other suitable radio-opaque material which provides sufficiently dense and dark lines. Marks, such as the notches shown in Fig 4, may be provided as an alternative to additional longitudinal threads which would increase the manufacturing cost and might obscure the bone image in use.

The number and extent of transverse wires may be chosen to suit the size and type of bone being set. A number of such devices with differing grid configurations may be made available for use. In the example of Fig 1 the aid measures 600 x 300 x 4 mm with the longitudinal wire and outer transverse wires extending to the periphery of the aid. The outer transverse wires are 70 mm from the respective ends and the intermediate wires are 50 mm apart and symmetrical about the centreline as shown.

Longer and wider grids may be used for determination of the mechanical axis of the limb and to perform comparisons between a pair of limbs.

A narrow perspex strip containing one longitudinal wire or a set comprising a calibrated protractor of radioopaque material may be placed on the aid to position and design osteotomies.

Claims

1. An aid for use in the real time radiographic analysis of a bone and comprising a sheet of x-ray pervious material at least as large as the bone and carrying a radio-opaque marker against which alignment of the bone may be checked.

2. An aid according to Claim 1 wherein the marker comprises one or more discrete wires of lead.

3. An aid according to Claim 1 or Claim 2 wherein the marker comprises a grid of discrete lead wires.

4. An aid according to Claim 3 wherein the grid comprises a longitudinal wire and a plurality of transverse wires extending on either side of said longitudinal wire.

5. An aid according to any preceding Claim wherein the marker is sealed within the sheet.

6. An aid according to any preceding Claim wherein the sheet is transparent.

7. An aid according to Claim 5 wherein the sheet is of perspex.

8. An aid according to Claim 7 wherein said sheet comprises two layers of perspex having said marker sandwiched therebetween.

9. A method of using an aid according to any preceding Claim in preparation of a bone for surgery or treatment, the method comprising the steps of:

placing the bone against said aid;

providing an x-ray image of the bone against said aid; and comparing the relative position of bone and marker.

10. A method according to Claim 9 and including a fourth step of:

adjusting the position of said bone until the image adopts a desired alignment.

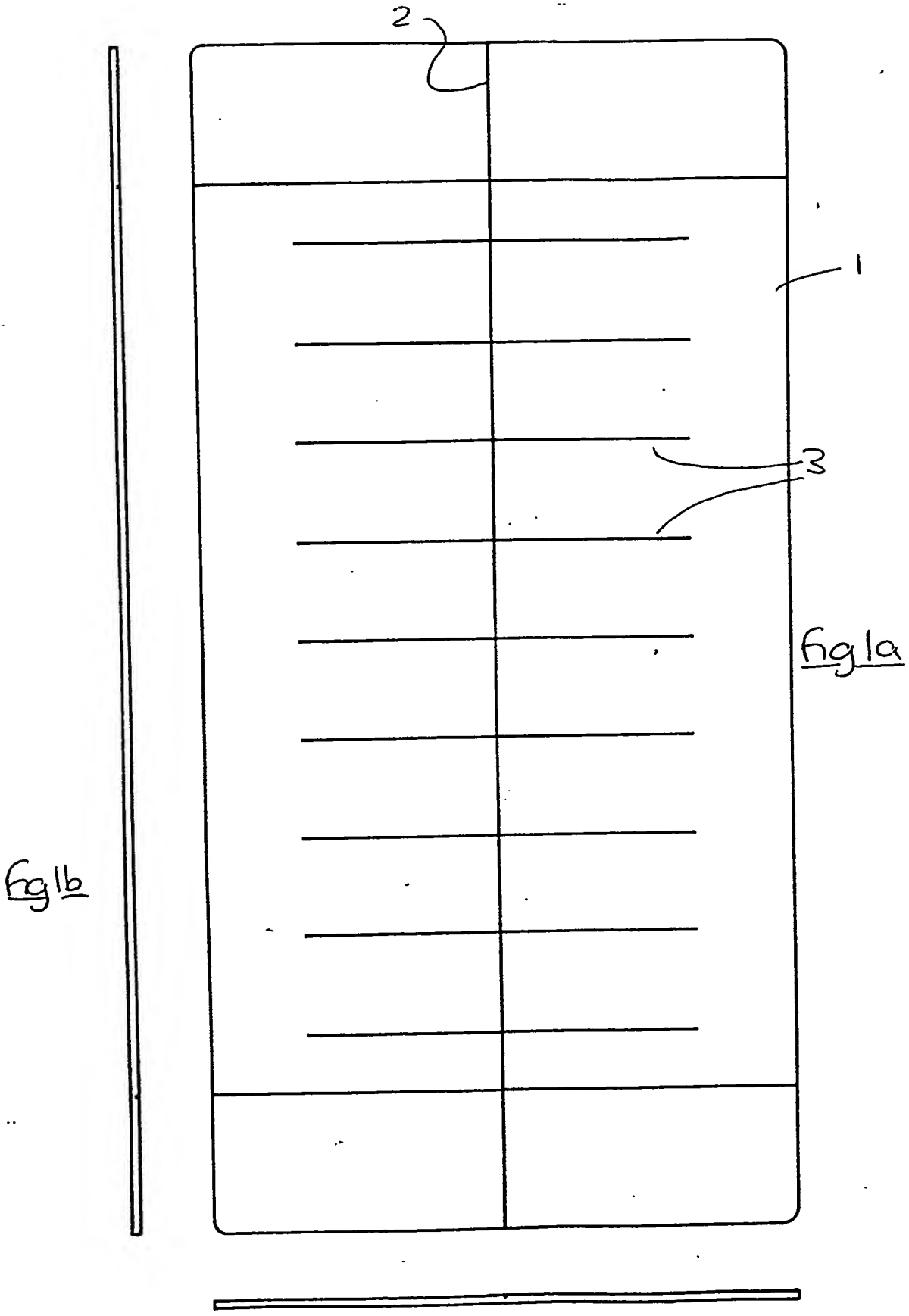


Fig 1a

Fig 1b

Fig 1c

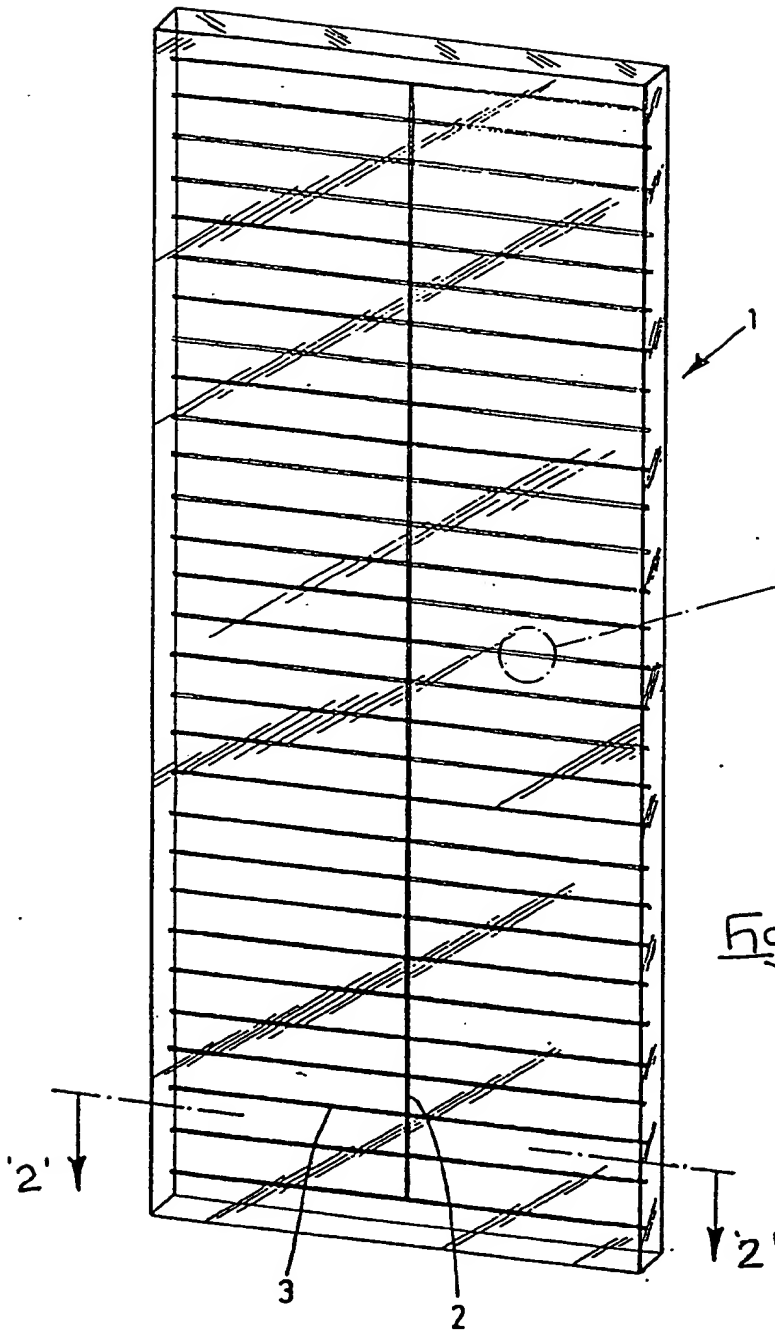


Fig 2a

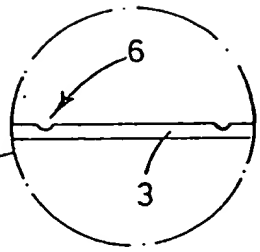


Fig 2c

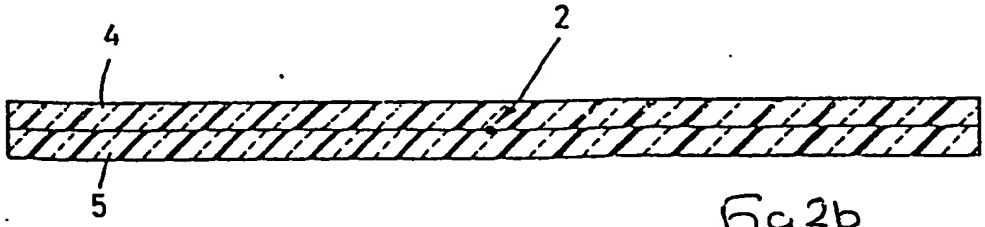


Fig 2b

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EUROPEAN SEARCH REPORT

Application Number

EP 90 30 2607

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	FR-A-2 166 671 (S. ALESSI) * page 1, line 17 - page 3, line 10; figures 1-7 *	1-5,9	A 61 B 6/12 A 61 B 19/00
A	---	6-8,10	
X	GB-A-1 458 196 (R.B.W. LOWNDES) * page 1, lines 20-92; page 2, lines 4-27; figure 1 *	1,5-8	
A	-----	9,10	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

A 61 B 19/00
A 61 B 6/00
G 03 B 42/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	05-06-1990	WEIHS J.A.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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